

**The Male Genitalia and Terminal Gastral Segments of Two  
Species of the Primitive Ant Genus *Myrmecia*  
(Hymenoptera: Formicidae)<sup>1</sup>**

JAMES FORBES

DEPARTMENT OF BIOLOGICAL SCIENCES, FORDHAM UNIVERSITY, BRONX, N. Y. 10458

**Abstract:** This is the first study of the complete male terminalia for members of the subfamily Myrmeciinae. Described and figured are the genitalic valves, terga IX and X, sterna VIII and IX for *M. tarsata* F. Smith and *M. vindex* F. Smith. The terminalia of these species conform to the usual formicid plan, but there are significant differences in each of the valves and in the terminal segments of these two species. The outer valves have a dorsal, median projection, which is not present in males of other subfamilies previously described. This projection is different for the two species. A sclerotized sliver, which is present on the anteroventral region of the median surface of the inner valves, varies in shape for each species. It has not been reported previously.

This is the first study of the complete male terminalia for members of the formicid subfamily Myrmeciinae; the genitalic valves, the ninth and tenth terga, the eighth sternum, and the ninth sternum are described and figured for *Myrmecia tarsata* F. Smith and *M. vindex* F. Smith. The only other known description of any of these segments is a diagram of the male genitalia of *M. pyriformis* by Emery (1911); however, at the time of his study this genus was included in the subfamily Ponerinae.

It has been suggested that a comprehensive study of the terminalia of the available males in this genus might aid in properly separating its species (Brown, 1953; Douglas and Brown, 1959). A beginning is made with this study, and the observations reported for *tarsata* and *vindex* could be the base line for such a survey. Descriptions and comparisons of the genitalic and terminal gastral segments of male ants are continually revealing differences in these structures, which will aid in the difficult taxonomy of these insects (Bernard, 1956; Borgmeier, 1950 and 1955; Krafchick, 1959; Forbes and Brassel, 1962).

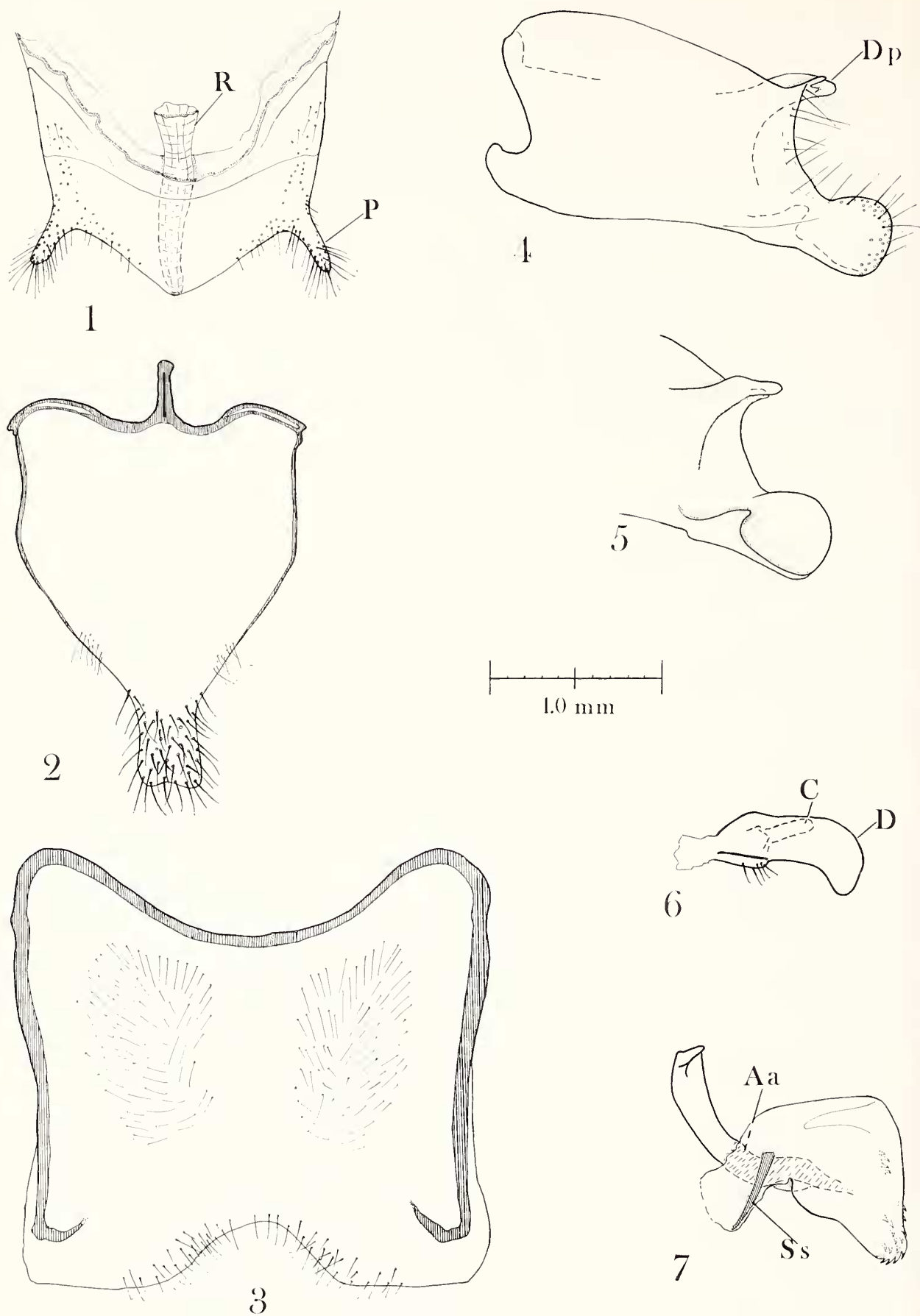
The *M. tarsata* and *vindex* males were alcohol-preserved specimens furnished by Dr. Caryl P. Haskins of the Carnegie Institution of Washington, D.C. from nests maintained by him. The terminalia were removed from the specimens and dehydrated through 95 percent alcohol. The various segments and the genitalic valves were separated and mounted in diaphane. The drawings were made with the aid of a Bausch and Lomb trisimplex projection apparatus.

OBSERVATIONS

The genitalia of these two species of *Myrmecia* are composed of three pairs of valves, the outer, the middle, and the inner, which are surrounded anteriorly

---

<sup>1</sup> This study was supported, in part, by a Fordham University Faculty Fellowship granted to the author.



FIGS. 1-7. Terminal segments and male genitalic valves of *Myrmecia tarsata*. All illustrations drawn to the same scale. FIG. 1. Terga IX and X. FIG. 2. Sternum IX. FIG. 3. Sternum VIII. FIG. 4. Lateral view of outer valve. FIG. 5. Median view of posterior end

by the basal ring. This is the typical formicid arrangement. The genitalia are retracted into a genital cavity at the posterior end of the gaster. The roof of this cavity is the anal segment which bears the pygostyles, and it consists of the ninth and tenth terga. The eighth tergum, the last external, dorsal segment, completely covers this anal segment; only the pygostyles project beneath it. The floor of the cavity is the subgenital plate, the ninth sternum. The posterior end of the ninth sternum may extend beyond the posterior margin of the last external, ventral segment, the seventh sternum. The eighth sternum lies between the seventh and the ninth sterna; it covers the anterior end of the subgenital plate and, in turn, is completely covered by the seventh sternum.

In previous reports on male ant genitalia (Forbes, 1952; Forbes and Brassel, 1962; Forbes and Hagopian, 1965) the terminology used was that of Snodgrass in his 1941 paper. In his study and in the observations previously made on male ant genitalia, the outer genitalic valve is separated into the basal portion, the lamina parameralis, and the terminal portion, the paramere. Since in *Myrmecia tarsata* and *M. vindex* the outer valves are not divided either completely or incompletely into the two regions, the single designation, paramere, is applied to this valve; this follows the 1957 revision of Snodgrass.

As the terminalia of these specimens were dissected from their surrounding segments and as the genitalic valves were separated from each other, it was noted that the intersegmental and connecting membranes were tough and resisted separation. Also, it was noted that the body wall muscle fibers which attach to these segments were large and strong. The tough membranes and strong body wall muscles suggest primitive characteristics as does the tough, hard integument of these ants.

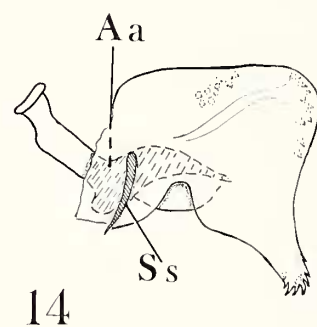
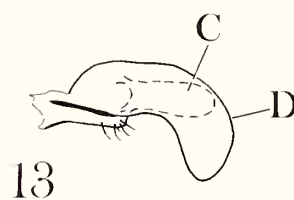
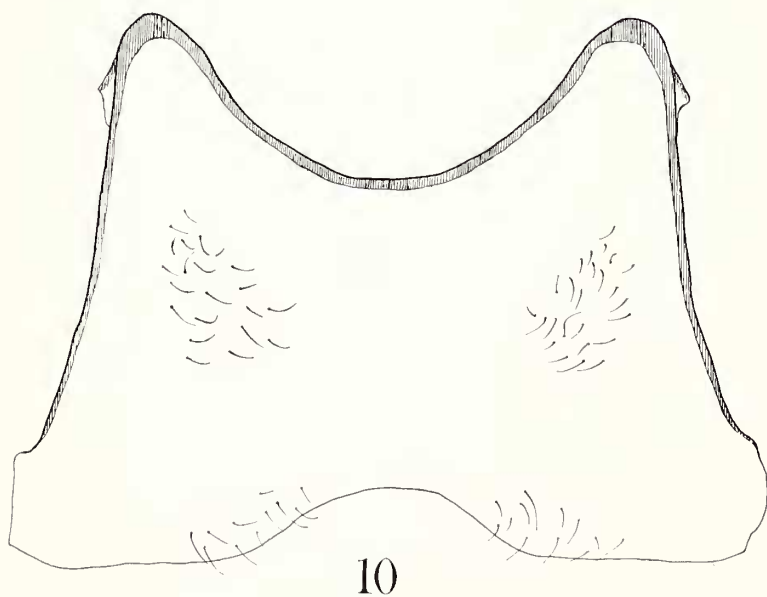
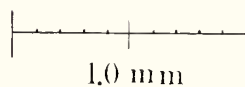
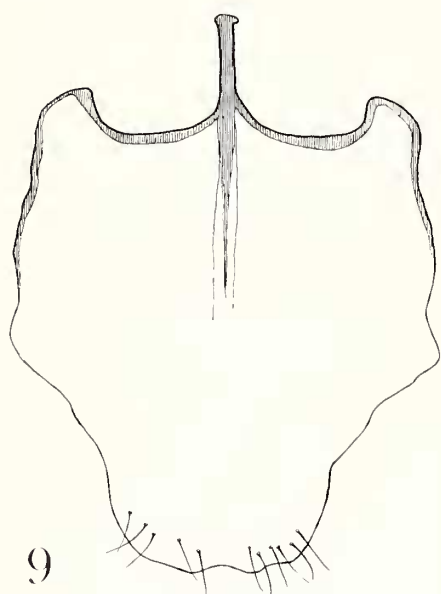
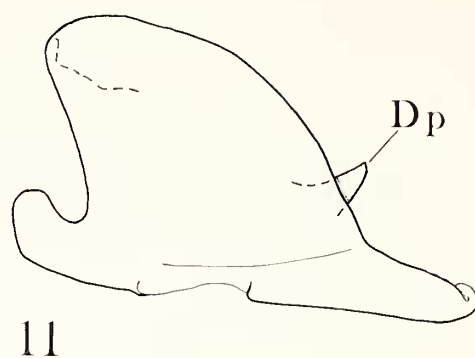
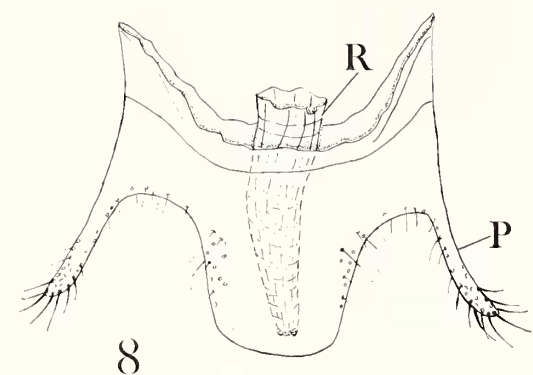
### *Myrmecia tarsata*

**Ninth and Tenth Terga** (Fig. 1). This dorsal, terminal segment bears the pygostyles, which are of moderate length. Its posterior margin is indented mediad of the pygostyles. The segment is weakly sclerotized throughout. The pygostyles are slightly more sclerotized than the rest of the segment. The boundaries of the lateral sclerites of the ninth tergum and of the anterior margin of the tenth tergum are indistinctly marked. There are sensory hairs on the pygostyles, and sensory pits are distributed along the lateral regions of the segment; some of these pits have small hairs.

---

←

of outer valve. FIG. 6. Median view of middle valve. FIG. 7. Median view of inner valve. Abbreviations: Aa, aedeagal apodeme; C, cuspis volsellaris; D, digitus volsellaris; Dp, dorsal median projection of outer valve; P, pygostyle; R, rectum; Ss, sclerotized sliver.



FIGS. 8-14. Terminal segments and male genitalic valves of *Myrmecia vindex*. All illustrations drawn to the same scale. FIG. 8. Terga IX and X. FIG. 9. Sternum IX. FIG. 10. Sternum VIII. FIG. 11. Lateral view of outer valve. FIG. 12. Median view of posterior end of outer valve. FIG. 13. Median view of middle valve. FIG. 14. Median view of inner valve.



**Eighth Sternum** (Fig. 3). This segment is roughly square in shape; it is a little wider than long, and its anterior and posterior margins are slightly indented. It is moderately sclerotized throughout with a more strongly sclerotized border along its anterior and lateral margins. The posterior margin is the least sclerotized, and the mid-lateral areas show a slightly darker pigmentation. There are patches of fine hairs on either side of the mid-line and along the posterior margin.

**Ninth Sternum** (Fig. 2). This triangular or shield-shaped subgenital plate has a bluntly pointed apex that is deflected ventrally. The segment is moderately sclerotized with more strongly sclerotized anterior and anterolateral margins; the slender, cranial apodeme is strongly sclerotized. Short hairs may be present on the posterior third, and larger sensory hairs are around the apex.

**Basal Ring or Lamina Annularis.** This is a broad, prominent, ring-shaped segment, which is moderately sclerotized throughout. Its dorsal, anterior margin is broadly indented, while its posterior margin is slightly indented at the mid-region. On the ventral surface, the mid-posterior indentation is deeper than the mid-anterior indentation.

**Outer Valves or Parameres** (Figs. 4 and 5). These valves are large and laterally convex. They almost encompass the middle and the inner valves. The ventral, posterior end of each valve is spoon-shaped with its lateral wall higher than the median wall. On the median wall there is a tooth-like projection. Also, on this valve there is a dorsal, median projection, which is blunt in shape and dorsoventrally flattened. The outer valve is moderately sclerotized. However, its posterior region including the dorsal, median projection is more strongly sclerotized than the rest of the valve. There are numerous, sensory pits on the posterior region, and long sensory hairs are attached to some of these pits.

**Middle Valves or Volsellares** (Fig. 6). These are the smallest and the most strongly sclerotized valves of the three pairs. In arrangement and shape, they are generally similar to reported descriptions for many ants. The anterior or basal portion of each middle valve, the lamina volsellaris, is attached to the ventral, median region of the outer valve, the paramere. A few sensory hairs are found at the ventral, posterior end of the lamina volsellaris. The lateral lobe, the cuspis volsellaris, is finger-shaped and short, but the median lobe, the digitus volsellaris, is broad, flat, and distally hooked. Numerous, small sensory pegs, the sensilla basiconica, are distributed over the dorsolateral area of the digitus and on the apposing surface of the tip of the cuspis.

**Inner Valves or Laminae Aedeagales** (Fig. 7). These are laterally compressed, moderately sclerotized valves, which are united dorsally by a less sclerotized membrane, the spatha. The ventral, posterior end of each valve projects downward and is toothed; sharp, tooth-like spines are situated on its

lateral face, and a few spines are located on the lateral, mid-posterior region. The anterodorsal extension of the aedeagal apodeme is a fairly thick rod. The median surface of the valve is quite smooth except for a low ridge along its dorsal, posterior region, and a flat, wedge-shaped, sclerotized sliver on the anterior region. The inner surface of the free, ventral margin is notched behind the sclerotized sliver.

*Myrmecia vindex*

**Ninth and Tenth Terga** (Fig. 8). This dorsal, terminal segment has long, slender pygostyles. Its posterior margin is deeply indented mediad of the pygostyles. The pygostyles are somewhat more sclerotized than the rest of the segment, which is weakly sclerotized. The boundaries of the lateral sclerites of the ninth tergum and the anterior margin of the tenth tergum are indistinct. Sensory hairs are located on the ends of the pygostyles and along the margins of the indentations.

**Eighth Sternum** (Fig. 10). This segment is trapezoid-shaped; it is wider at its posterior margin than at its anterior margin. The anterior margin is broadly indented, while the posterior margin has a small indentation in the mid-region. The segment is moderately sclerotized. However, the posterior margin is weakly sclerotized, and the anterior and lateral margins are more strongly sclerotized than the remainder of the segment. Some short hairs are located on the lateral regions and along the posterior margin on either side of the indentation.

**Ninth Sternum** (Fig. 9). The subgenital plate is shield-shaped with a rounded, posterior margin on which are a few moderately long sensory hairs. The long, slender cranial apodeme is flanked by less extended, lateral apodemes. The segment is moderately sclerotized; the anterior and the anterolateral margins are more strongly sclerotized. The posterior region is darker in color than the central region.

**Basal Ring or Lamina Annularis.** In general shape, arrangement, and sclerotization this segment in *vindex* conforms to the descriptions for *tarsata*. While in *tarsata* the basal ring is uniform in width from front to back, in *vindex* the anterior diameter is a little smaller than the posterior diameter so that this segment tapers anteriorly.

**Outer Valves or Parameres** (Figs. 11 and 12). These are large, laterally convex valves, which almost enclose the middle and the inner valves. The dorsal surface of each valve curves ventrally and continues to the posterior end, which is a blunt hook that is turned medially. There are slight variations in the length and downward tilt of this posterior hook. The dorsal, median projection of this valve arises just below the middle of the valve, and it is short and sharply pointed. Some slight variations have been noted in the position and in the tilt



of this dorsal projection. The outer valves are moderately sclerotized, and the posterior end is slightly more sclerotized. There are only a few, long sensory hairs on the posterior margin of this valve.

**Middle Valves or Volsellares** (Fig. 13). These valves are the smallest and the most strongly sclerotized in this species. The lamina volsellaris of each middle valve is attached to the ventral, median region of the outer valve. A few, small sensory hairs are located on the ventral, posterior end of the lamina volsellaris. The digitus volsellaris is broad and sharply hooked. The cuspis volsellaris is a relatively broad, finger-shaped lobe. Almost the entire lateral surface of the digitus is covered with sensilla basiconica, while the cuspis has these sensilla only on the distal end of its median surface.

**Inner Valves or Laminae Aedeagales** (Fig. 14). These laterally compressed and moderately sclerotized valves are united dorsally by the less sclerotized spatha. The ventral, posterior end of each valve is narrow and serrated and projects downward. A few, sharply pointed spines are found on its lateral surface. Scattered spines are also found on the lateral surface of the valve in the posterior region, and a small cluster of spines projects from the middle, dorsal area. The anterior extension of the aedeagal apodeme is a rod of moderate size. The median surface of the valve is quite smooth except for a low ridge along the dorsal, posterior region. The sclerotized sliver on the median, anteroventral region is small and slightly bent. The inner face of the free, ventral margin is indented behind the sclerotized sliver.

#### DISCUSSION

The terminalia of *Myrmecia tarsata* and *vindex* conform to the usual formicid plan, but significant differences are described and figured for each of the genitalic valves and for the terminal, gastral segments in these two species.

The outer valves of members of this genus have a dorsal, median projection, which has not been reported for other ants. Emery's diagram (1911) of the undissected genitalia of *Myrmecia pyriformis* shows this to be a sharp, finger-like projection. The descriptions of the *Myrmecia* male in Emery's study and also in the revisionary study of the subfamily Myrmeciinae by Clark (1951) state that a median, dorsal, styliform appendage is present on the outer valve. A dorsal projection is present on the outer valves of *tarsata* and *vindex*, but it is not styliform; the shape varies with the species.

Emery's diagram of the ventral view of the outer valve shows a separation between the posterior and the anterior or basal portion of this valve. In this paper the entire outer valve is called the paramere since no such separation is seen in the outer valves of either *tarsata* or *vindex*.

The sclerotized sliver situated on the anterior region of the median surface of the inner valve has not been previously reported in studies of male ant genitalia. Its shape is different in both *tarsata* and *vindex*.

## Literature Cited

- BERNARD, F. 1956. Révision des *Leptothorax* (Hyménoptères, Formicidae) d'Europe occidentale basée sur la biométrie et les genitalia males. Bull. Soc. Zool. France, **81**: 151-165.
- BORGMEIER, T. 1950. Estudos sobre *Atta* (Hym., Formicidae). Mem. Inst. Oswaldo Cruz, **48**: 239-246.
- . 1955. Die Wanderameisen der Neotropischen Region (Hym., Formicidae). Editora Vozes Limitada, Petropolis, R. J. Brasil, **3**: 9-716.
- BROWN, W. L., JR. 1953. Characters and synonymies among the genera of ants. I. Breviora, no. 11, 13 pp.
- CLARK, J. 1951. The Formicidae of Australia. I. Subfamily Myrmeciinae. 230 pp. Commonwealth Scient. Industr. Res. Organ., Melbourne, Australia.
- DOUGLAS, A. AND W. L. BROWN, JR. 1959. *Myrmecia inquilina* new species: the first parasite among the lower ants. Insectes Sociaux, **6**: 13-19.
- EMERY, C. 1911. In Wytsman's Genera Insectorum. Fasc., **118**: 124 pp. (Ponerinae).
- FORBES, J. 1952. The genitalia and terminal segments of the male carpenter ant, *Campopnotus pennsylvanicus* De Geer (Formicidae, Hymenoptera). Jour. N. Y. Ent. Soc., **60**: 157-171.
- , AND R. W. BRASSEL. 1962. The male genitalia and terminal segments of some members of the Genus *Polyergus* (Hymenoptera: Formicidae). Jour. N. Y. Ent. Soc., **70**: 79-87.
- , AND M. HAGOPIAN. 1965. The male genitalia and terminal segments of the ponerine ant *Rhytidoponera metallica* F. Smith (Hymenoptera: Formicidae). Jour. N. Y. Ent. Soc., **73**: 190-194.
- KRAFCHICK, B. 1959. A comparative study of the male genitalia of North American ants (Formicidae) with emphasis on generic differences. Dissertation, Univ. of Maryland, 78 pp. (Univ. Microfilms, Inc., Ann Arbor, Mich.).
- SNODGRASS, R. E. 1941. The male genitalia of Hymenoptera. Smithsonian Misc. Coll., **99**: (14): 1-86.
- . 1957. A revised interpretation of the external reproductive organs of male insects. Smithsonian Misc. Coll., **135** (6): 1-60.

SUBMITTED FOR PUBLICATION DECEMBER 20, 1966